

Climate Change Information Resources

New York Metropolitan Region

(CCIR-NYC)



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How does climate change today compare with climate change in the past?

Key Points

Climate scientists reconstruct the Earth's climate history by studying proxy records including ice cores, corals, and tree rings. These records show natural variability in the Earth's climate such as distinct colder glacial periods and warmer interglacial periods. One particularly well-documented example is the Younger Dryas. Recent human-induced climate change is outpacing examples of historical climate change.

Younger Dryas

The transition from the peak of the last ice age around 20,000 years ago to the start of the modern interglacial period (the Holocene) around 10,000 years ago, was interrupted by a sharp return to near-glacial conditions during the Younger Dryas period. This period lasted from about 13,000 years ago to 11,500 years ago. The onset of this cold period took a couple of hundred years, but its termination was extremely

rapid (over decades). The strongest cooling during this period occurred in the areas around the North Atlantic Ocean (Greenland, Europe, Western Canada), but its impacts were felt globally, as far away as the Californian coast and China.

At the end of the Younger Dryas, ice sheets that had extended down to the New York metropolitan region began to retreat and the climate shifted from a glacial to an interglacial state.

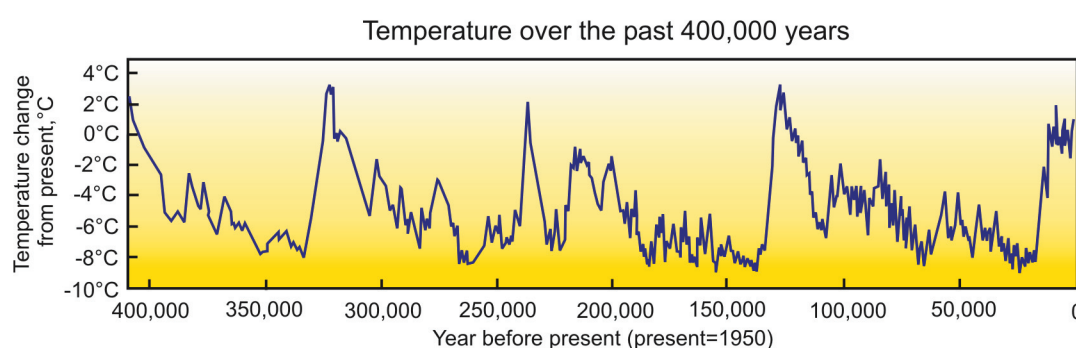


Figure 1. Temperature changes in the past 400,000 years. Source: Petit, J.R., J. Jouzel, D. Raynaud, et al. "Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica." *Nature* 399(6735), 429-436, 1999.

Studying the Climate Record

Climate scientists glean information about past climates by studying ice cores, sediments from the ocean, corals, tree rings, and the geologic record. From these proxy records, they reconstruct Earth's climate history and compare climate changes of the past with observations of recent climate changes and their projections of climate change in the twenty-first century.

Earth's Dynamic Climate

Scientists have long known that the Earth's climate is dynamic, fluctuating between colder and warmer periods generally referred to as glacial and interglacial states (Figure 1). Despite these swings, the Earth has supported life for the past four million years. Historically, climate changes have usually occurred on timescales of thousands of years, although there well-documented exceptions such as the Younger Dryas when climate change has occurred more quickly.

Due to the rapid addition of greenhouse gases to the atmosphere, especially since the Industrial Revolution, climatologists expect to observe greater changes in the Earth's climate over the next century than have been recorded over approximately the past 12,000 years.

The Past 1500 Years

Temperatures began increasing in northern latitudes around 600 AD and warming occurred in other regions up until about 1250 AD due to natural variability in the Earth's orbit. Areas of

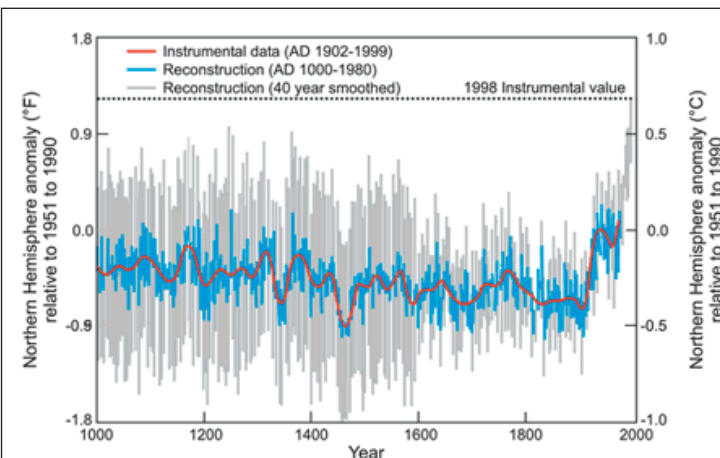


Figure 2. Temperature reconstruction for the past thousand years. Data shown in red are observations from instruments, blue are from tree rings, corals, ice cores and historical records. Source: Intergovernmental Panel on Climate Change (IPCC), *Technical Summary of Working Group I Report, Third Assessment Report*. 2001.

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Greenland were colonized that were previously too cold for food cultivation. This period is sometimes referred to as the Medieval Warm Period, although the warming did not occur on a global scale.

Between 1250 and 1850, a period of cooler temperatures known as the Little Ice Age occurred (Figure 2). Although temperatures tended to be cooler than average, the Little Ice Age was not a continuous time period of colder than normal temperatures because summers were often very warm. Between 1250 AD and the early 1500s, the climate cooled slowly and then appeared to be stabilizing with the exception of the North Atlantic where temperatures began to decrease rapidly. Glaciers that had been receding re-advanced and large bodies of water remained frozen through the summers. Volcanic activity contributed to the cooling during the Little Ice Age. The average temperature during the Little Ice Age was about 1.8°F (1°C) cooler than it is today.

Climate Change in the Twentieth Century and Beyond

In the twentieth century, global temperature averaged over land and ocean areas warmed by 1.08°F (0.6°C) (Figure 3). The rise was not uniform in time or space. For example, temperatures increased in the first part of the 20th century and then decreased between about 1940 and 1970. Also, temperature rise has been greater in the northern high-latitudes. Between 1970 and today, temperatures have warmed, and the 1990s saw some of the hottest years of the twentieth century.

If the current trend continues, temperatures will be more than ~1.8°F (1°C) warmer by 2100 than they were in 1900. However, climate models used by the Intergovernmental Panel on Climate Change (IPCC) project that the climate will warm 2.25

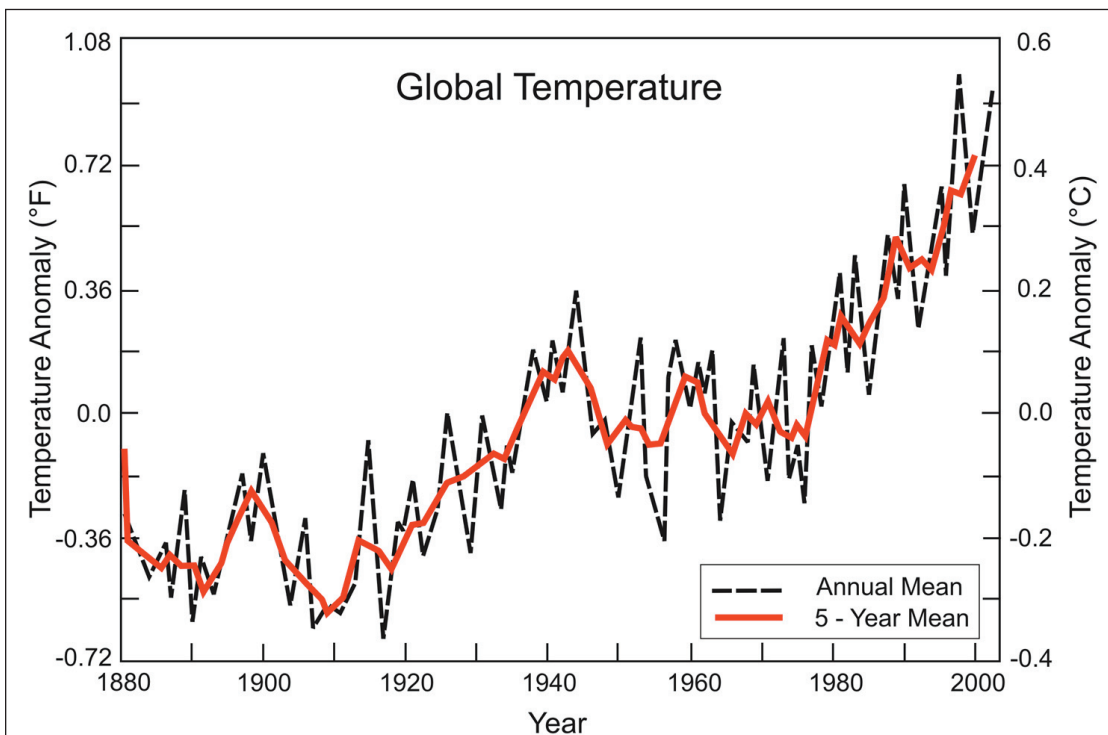


Figure 3. Temperature changes over the past one hundred and twenty years. Source: NASA Goddard Institute for Space Studies (NASA GISS) 2001. <http://www.giss.nasa.gov/data/update/gistemp/graphs/>

- 10.44°F (1.4 - 5.8°C) in the twenty-first century, outpacing the warming trend of the twentieth century, and at the higher end comparable in magnitude to the temperature swing in the Younger Dryas, when temperatures were only 9-12.6°F (5 - 7°C) cooler than the global temperature today. Therefore, the IPCC projections for the future are within a range of temperatures that could lead to a major climate shift.

References

Intergovernmental Panel on Climate Change (IPCC), 2001. "Working Group I Third Assessment Report." *Cambridge University Press*. Cambridge, UK. 881 pp.

National Academy of Sciences (NAS). 2001. "Climate Change Science: An Analysis of Some Key Questions." *National Academies Press*. 42 pp.

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